

This listing of claims will replace all prior versions,
and listings, of claims in the application:

1 Claims 1-6 (canceled)

1 Claim 7 (previously presented): Apparatus for use in a
2 base station in an orthogonal frequency division
3 multiplexing (OFDM) based spread spectrum multiple access
4 wireless system comprising:

5 a sequence generator for generating one or more pilot
6 tone hopping sequences each including pilot tones, said
7 pilot tones each being generated at frequency and time
8 instants in a time-frequency grid;

9 a waveform generator, responsive to said one or more
10 pilot tone hopping sequences, for generating a waveform for
11 transmission;

12 wherein said sequence generator generates each of
13 said one or more pilot tone hopping sequences in accordance
14 with $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$; and

15 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a
16 time instant index, "T", "a", "s_i" and "d" are integer
17 constants, "p" is a prime constant, and "Z" is a
18 permutation operator.

1 Claim 8 (original): The invention as defined in claim 7
2 wherein said prescribed number of symbol intervals T is a
3 prime number.

1 Claim 9 (original): The invention as defined in claim 7
2 wherein each of said one or more pilot tone hopping

3 sequences generated includes a prime number of distinct
4 tones.

1 Claim 10 (previously presented): The invention as defined
2 in claim 7 wherein said permutation operator Z is defined
3 on $[\text{MIN}(0, d), \text{MAX}(N, -1, p-1+d)]$ and " N ," is the total
4 number of tones in the system, p is a prime number of tones
5 and " d " is a frequency.

1 Claim 11 (previously presented): The invention as defined
2 in claim 7 wherein each of said one or more pilot tone
3 hopping sequences has a slope " a ".

1 Claim 12 (original): The invention as defined in claim 11
2 wherein said slope " a " is unique to said base station among
3 one or more neighboring base stations.

1 Claim 13 (previously presented): Apparatus for use in a
2 base station in an orthogonal frequency division
3 multiplexing (OFDM) based spread spectrum multiple access
4 wireless system comprising:

5 a sequence generator for generating one or more pilot
6 tone hopping sequences each including pilot tones, said
7 pilot tones each being generated at frequency and time
8 instants in a time-frequency grid;

9 a waveform generator, responsive to said one or more
10 pilot tone hopping sequences, for generating a waveform for
11 transmission; and

12 wherein said waveform generator generates a waveform

13 in accordance with $\sum_{i=1}^{N_{\text{pilot}}} C_k^{S_i} e^{2\pi f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the

14 sequence $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, Δf is the basic
 15 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
 16 symbol to be transmitted at the k^{th} symbol instant and tone
 17 $f_k^{S_i}$.

1 Claim 14 (original): The invention as defined in claim 13
 2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 15 (previously presented): Apparatus for use in a
 2 base station in an orthogonal frequency division
 3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system comprising:

5 a sequence generator for generating one or more pilot
 6 tone hopping sequences each including pilot tones, said
 7 pilot tones each being generated at frequency and time
 8 instants in a time-frequency grid; and

9 a waveform generator, responsive to said one or more
 10 pilot tone hopping sequences, for generating a waveform for
 11 transmission,

12 wherein said waveform generator generates a waveform
 13 in accordance with $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the
 14 sequence $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, Δf is the basic
 15 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
 16 symbol to be transmitted at the k^{th} symbol instant and tone
 17 $f_k^{S_i}$, and $\Gamma_k^{S_i} = 1$, if $f_k^{S_i} \in [0, N, -1]$, and $\Gamma_k^{S_i} = 0$, otherwise.

1 Claim 16 (original): The invention as defined in claim 15
 2 wherein $f_k^s = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 17 (original): The invention as defined in claim 16
 2 wherein said waveform generator includes a transmitter for
 3 transmitting said pilot tones and wherein pilot tones in
 4 phantom tone regions defined by $[\text{MIN}(0, d), 0]$ and $[N_t - 1,$
 5 $\text{MAX}(N_t - 1, p - 1 + d)]$, where "N_t" is the total number of tones
 6 in the system, p is a prime number of tones and "d" is a
 7 prescribed frequency, are not transmitted

1 Claims 18 - 23 (canceled)

1 Claim 24 (previously presented): A method for use in a
 2 base station in an orthogonal frequency division
 3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system comprising the steps of:
 5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being
 7 generated at frequency and time instants in a
 8 time-frequency grid;
 9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission; and
 11 wherein said step of generating one or more pilot tone
 12 hopping sequences includes a step of generating each of
 13 said one or more pilot tone hopping sequences in accordance
 14 with $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i = 1, \dots, N_{pil}$, and

15 wherein $f_k^s = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
16 instant index, "T", "a", "s_i" and "d" are integer constants,
17 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 25 (original): The method as defined in claim 24
2 wherein said prescribed number of symbol intervals T is a
3 prime number.

1 Claim 26 (original): The method as defined in claim 24
2 wherein said step of generating one or more pilot tone
3 hopping sequences includes a step of generating each of
4 said one or more pilot tone hopping sequences having a
5 prime number of distinct tones.

1 Claim 27 (previously presented): The method as defined in
2 claim 24 wherein said permutation operator Z is defined on
3 [MIN (0, d), MAX (N, -1, p-1+d)] and "N," is the total
4 number of tones in the system, p is a prime number of tones
5 and "d" is a frequency.

1 Claim 28 (previously presented): The method as defined in
2 claim 24 wherein said step of generating one or more pilot
3 tone hopping sequences includes a step of generating each
4 of said one or more pilot tone hopping sequences having a
5 slope "a".

1 Claim 29 (original): The method as defined in claim 28
2 wherein said slope "a" is unique to said base station among
3 one or more neighboring base stations.

1 Claim 30 (previously presented): A method for use in a
 2 base station in an orthogonal frequency division
 3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system comprising the steps of:
 5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being
 7 generated at frequency and time instants in a
 8 time-frequency grid;
 9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission; and
 11 wherein said step of generating said waveform includes
 12 a step of generating said waveform in accordance with
 13 $\sum_{i=1}^{N_{pq}} C_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the sequence
 14 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic
 15 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
 16 symbol to be transmitted at the k^{th} symbol instant and tone
 17 $f_k^{S_i}$.

1 Claim 31 (original): The method as defined in claim 30
 2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 32 (previously presented): A method for use in a
 2 base station in an orthogonal frequency division
 3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system comprising the steps of:
 5 generating one or more pilot tone hopping sequences
 6 each including pilot tones, said pilot tones each being

7 generated at frequency and time instants in a
 8 time-frequency grid;
 9 in response to said one or more pilot tone hopping
 10 sequences, generating a waveform for transmission; and
 11 wherein said step of generating said waveform includes
 12 a step of generating said waveform in accordance with
 13 $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the sequence
 14 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic
 15 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known
 16 symbol to be transmitted at the k^{th} symbol instant and tone
 17 $f_k^{S_i}$, and $\Gamma_k^{S_i} = 1$, if $f_k^{S_i} \in [0, N_t - 1]$, and $\Gamma_k^{S_i} = 0$, otherwise.

1 Claim 33 (original): The method as defined in claim 32
 2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 34 (original): The method as defined in claim 33
 2 further including a step of transmitting said pilot tones
 3 and wherein pilot tones in phantom tone regions defined by
 4 $[\text{MIN}(0, d), 0]$ and $[N_t - 1, \text{MAX}(N_t - 1, p - 1 + d)]$, where " N_t "
 5 is the total number of tones in the system, p is a prime
 6 number of tones and "d" is a prescribed frequency are not
 7 transmitted.

1 Claims 35 - 40 (canceled)

1 Claim 41 (previously presented): Apparatus for use in a
 2 base station in an orthogonal frequency division

3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system comprising:
 5 means for generating one or more pilot tone hopping
 6 sequences each including pilot tones, said pilot tones each
 7 being generated at frequency and time instants in a
 8 time-frequency grid; and
 9 means, responsive to said one or more pilot tone
 10 hopping sequences, for generating a waveform for
 11 transmission,
 12 wherein said step of generating one or more pilot tone
 13 hopping sequences includes a step of generating each of
 14 said one or more pilot tone hopping sequences in accordance
 15 with $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, and
 16 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 17 instant index, "T", "a", " s_i " and "d" are integer constants,
 18 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 42 (original): The invention as defined in claim 41
 2 wherein said prescribed number of symbol intervals T is a
 3 prime number.

1 Claim 43 (original): The invention as defined in claim 41
 2 wherein said means for generating one or more pilot tone
 3 hopping sequences includes means for generating each of
 4 said one or more pilot tone hopping sequences having a
 5 prime number of distinct tones.

1 Claim 44 (original): The invention as defined in claim 41
 2 wherein said permutation operator Z is defined on $[\text{MIN}(0,$
 3 $d), \text{MAX}(N_i - 1, p - 1 + d)]$ and " N_i " is the total number of

4 tones in the system, p is a prime number of tones and " d "
5 is a prescribed frequency.

1 Claim 45 (previously presented): The invention as defined
2 in claim 41 wherein said means for generating one or more
3 pilot tone hopping sequences includes means for generating
4 each of said one or more pilot tone hopping sequences
5 having a slope " a ".

1 Claim 46 (original): The invention as defined in claim 45
2 wherein said slope " a " is unique to said base station among
3 one or more neighboring base stations.

1 Claim 47 (previously presented): Apparatus for use in a
2 base station in an orthogonal frequency division
3 multiplexing (OFDM) based spread spectrum multiple access
4 wireless system comprising:

5 means for generating one or more pilot tone hopping
6 sequences each including pilot tones, said pilot tones each
7 being generated at frequency and time instants in a
8 time-frequency grid;

9 means, responsive to said one or more pilot tone
10 hopping sequences, for generating a waveform for
11 transmission; and

12 wherein said means for generating said waveform
13 includes means for generating said waveform in accordance

14 with $\sum_{i=1}^{N_{pil}} C_k^{S_i} e^{2\pi j f_i \Delta t}$, where $f_k^{S_i}$ are given by the sequence

15 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic

16 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known

17 symbol to be transmitted at the k^{th} symbol instant and tone
 18 $f_k^{S_i}$.

1 Claim 48 (original): The invention as defined in claim 47
 2 wherein $f_k^{S_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
 3 instant index, "T", "a", "s_i" and "d" are integer constants,
 4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 49 (previously presented): Apparatus for use in a
 2 base station in an orthogonal frequency division
 3 multiplexing (OFDM) based spread spectrum multiple access
 4 wireless system comprising:

5 means for generating one or more pilot tone hopping
 6 sequences each including pilot tones, said pilot tones each
 7 being generated at frequency and time instants in a time-
 8 frequency grid;

9 means, responsive to said one or more pilot tone
 10 hopping sequences, for generating a waveform for
 11 transmission; and

12 wherein said means for generating said waveform
 13 includes means for generating said waveform in accordance

14 with $\sum_{i=1}^{N_{pil}} C_k^{S_i} \Gamma_k^{S_i} e^{2\pi j f_k^{S_i} \Delta t}$, where $f_k^{S_i}$ are given by the sequence

15 $S_i = \{f_0^{S_i}, f_1^{S_i}, \dots, f_k^{S_i}, \dots\}$, for $i=1, \dots, N_{pil}$, where Δf is the basic

16 frequency spacing between adjacent tones, $C_k^{S_i}$ is a known

17 symbol to be transmitted at the k^{th} symbol instant and tone

18 $f_k^{S_i}$, and $\Gamma_k^{S_i} = 1$, if $f_k^{S_i} \in [0, N_f - 1]$, and $\Gamma_k^{S_i} = 0$, otherwise.

1 Claim 50 (original): The invention as defined in claim 49
2 wherein $f_k^{s_i} = Z\{(a(k \bmod T) + s_i) \bmod p + d\}$, where "k" is a time
3 instant index, "T", "a", "s_i" and "d" are integer constants,
4 "p" is a prime constant, and "Z" is a permutation operator.

1 Claim 51 (original): The invention as defined in claim 50
2 further including means for transmitting said pilot tones
3 and wherein pilot tones in phantom tone regions defined by
4 $[\text{MIN}(0, d), 0]$ and $[N_t - 1, \text{MAX}(N_t - 1, p - 1 + d)]$, where "N_t"
5 is the total number of tones in the system, p is a prime
6 number of tones and "d" is a prescribed frequency are not
7 transmitted.

1 Claim 52 (new): The invention as defined in claim 7
2 wherein said pilot tone hopping sequence generated by said
3 sequence generator is a truncated Latin Square based
4 hopping sequence.